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New record and distribution extension of the rare Atlantic Forest endemic *Abrawayaomys ruschii* Cunha & Cruz, 1979 (Rodentia, Sigmodontinae)

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Abstract: We recorded three individuals of *Abrawayaomys ruschii* Cunha & Cruz, 1979 in Chapecó, Santa Catarina state, expanding the known geographic distribution of the species in approximately 370 km west from its nearest locality. It is the second record of the species in this type of physiognomy, characterized by the transition of Seasonal Deciduous and Mixed Ombrophilous forests. Additionally, this is the closest record, about 200 km east, from the recently described *Abrawayaomys chebezi* Pardiñas, Teta & D'Elía, 2009.

Key words: *Abrawayaomys chebezi*, Misiones, morphometrics, Santa Catarina

The genus *Abrawayaomys* Cunha & Cruz, 1979 is one of the least known among the living sigmodontines (D'Elía et al. 2007; Pardiñas et al. 2009). It can be distinguished by presenting a peculiar spiky fur and unusual craniodental morphology (Pardinãs et al. 2009). Currently, this genus is composed by only two species: *Abrawayaomys ruschii* Cunha & Cruz, 1979 and *Abrawayaomys chebezi* Pardiñas, Teta & D'Elía, 2009. *Abrawayaomys* spp. are found in the Atlantic Forest of Argentina and Brazil, but there are few confirmed records for these species. *Abrawayaomys chebezi* had its description based on a single individual preserved as skin and skull, with three craniodental remains recovered from *Tyto alba* owl pellets constituting additional distributional records, comprising four distinct localities in the Misiones province, Argentina (Pardinãs et al. 2009); and *A. ruschii* that presents a slightly higher number of specimens collected in south and southeastern Brazil in the states of Espírito Santo, Minas Gerais, Paraná, Santa Catarina, and Rio de Janeiro (Pereira et al. 2008; Cherem et al. 2011; Passamani et al. 2011; Ventura et al. 2013; Cerboncini et al. 2014). *A. ruschii* is currently classified as Least Concern (LC) according to IUCN Red list of Threatened Species, however, there is little information on its occurrence extension, conservation status, threat degree and ecological requirements (Pardiñas et al. 2008).

In this article we expand the known distributional range of *A. ruschii* in approximately 370 linear km west of its nearest locality previously recorded at the State Park of Serra do Tabuleiro, on the coast of Santa Catarina state (Cherem et al. 2011). The new record is located in the city of Chapecó, also in Santa Catarina state, southern Brazil (27°08′32″ S, 052°42′59″ W), in a fragment of native forest with approximately 200 hectares (Figure 1). The sample site is located in a transitional region between the phytophysiognomies of Seasonal Deciduous and Mixed Ombrophilous forests (known as forest with Araucaria), inside the Atlantic Forest domain, at an altitude of about 600 m (IBGE 2011). The climate is defined as Cfb type according to Köppen climate classification (Peel et al. 2007), characterized by humid mesothermic with annual average temperatures ranging between 18°C and 19°C and annual average rainfall of 1,800 mm. Rainfall is equally distributed throughout the year. The area is a private property of a food industry (Cooperativa Central Oeste Catarinense—AURORA), and it is not protected as a conservation unit. Historically, the study area has been affected by selective removal of wood and use of the land for cellulose monoculture. Part of the area is now in regeneration process, but is still subject to disturbances, especially illegal hunting (Maestri et al. 2014).

The sampling was conducted over a period of 13 months (August 2011 to September 2012). Interception and fall traps (pitfall traps) were installed in five distinct sampling sites, distant at least 400 m between each other. At each sampling site a pitfall trap station was installed; each formed a Y–shape, and consisted of 10 buckets with capacity of 100 L each, 10 m apart from each other, and interconnected by a guide-fence 50 cm high. The buckets remained open for 10 days per month over the sampled period, comprising a total sampling effort of 6,500 bucket-nights. The traps were daily reviewed during the sampling periods. Two adult females and an adult male (age classes 3–5; see the toothwear criteria established by Patterson 1992) of *A. ruschii* were captured on 31 August 2011; 15 April 2012 and 19 September 2012, respectively. The

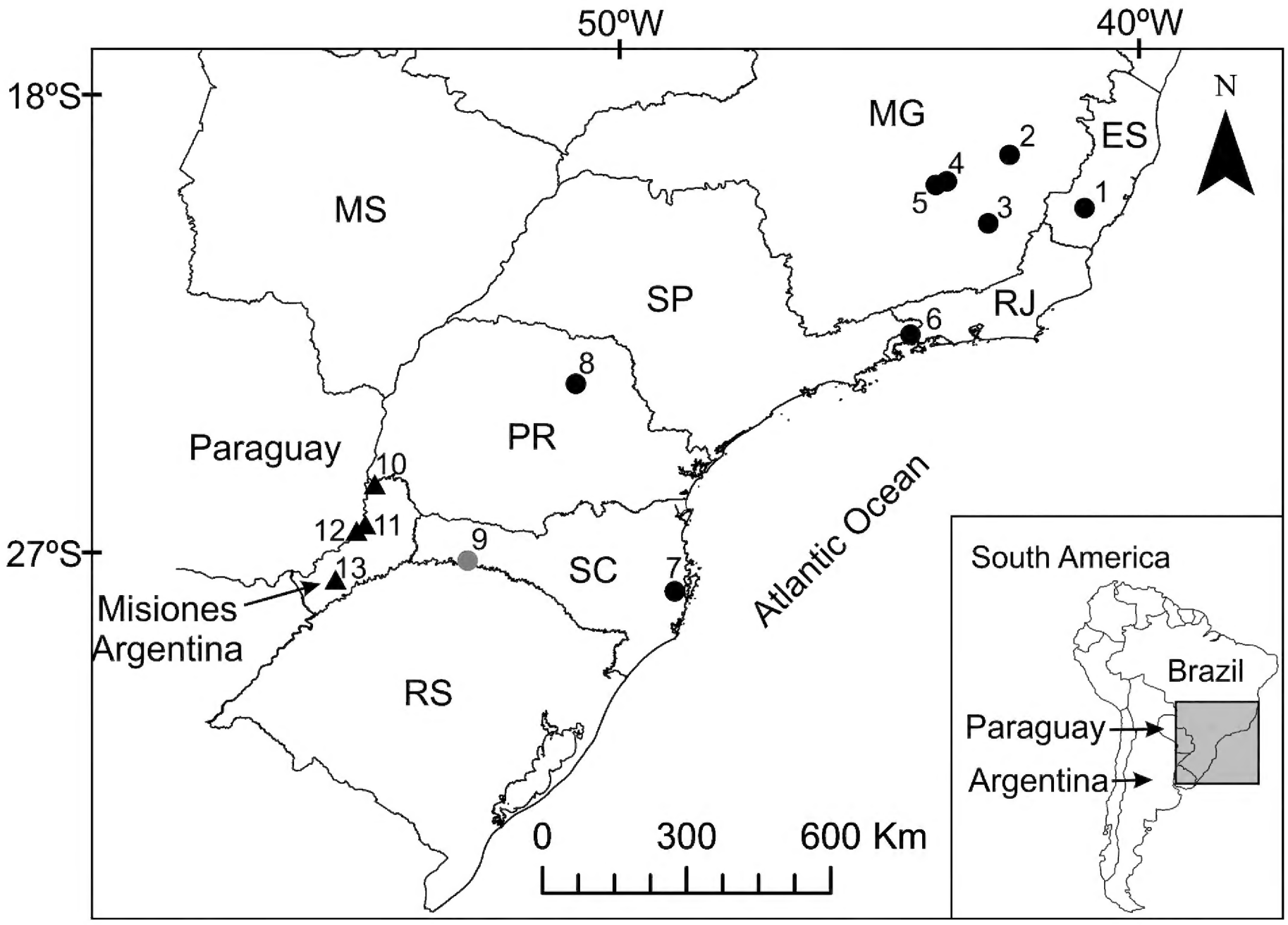

Figure 1. Map showing the collection localities of *Abrawayaomys ruschii* (circles) and *A. chebezi* (triangles), with the new record in red. Collection sites of *A. ruschii* modified from Passamani et al. (2011): Espírito Santo: 1. Reserva Biológica de Forno Grande (20°30′ S, 041°06′ W). Minas Gerais: 2. Parque Estadual do Rio Doce (19°30′S, 042°31′W); 3. Viçosa (20°47′S, 042°55′W); 4. Caeté (20°00′S, 043°42′W); 5. São Sebastião das Águas Claras (20°04′S, 043°54′ W). Rio de Janeiro: 6. Aldeia Sapucaí (22°53′S, 044°23′W). Santa Catarina: 7. Santo Amaro da Imperatriz (27°41′S, 048°46′W); Paraná: 8. RPPN Monte Sinai, Mauá da Serra (23°47′ S, 050°30′ W) and UHE Mauá, Telêmaco Borba (23°09′ S, 050°42′ W); Santa Catarina: 9. Chapecó (27°08′S, 052°42′W). Localities of *A. chebezi* based on Pardinãs *et al*. (2009): Misiones, Argentina: 10. Conjunction arroyo Mbocai and route 12 (25°40′ S, 054°30′ W, type locality); 11. Eldorado (26°24′ S, 54°31 W); 12. Montecarlo (26°34′ S, 54°44′ W); 13. Campo Ramón (27°25′ S, 055°1′ W).

specimens were collected under permanent license number 15224-2 (IBAMA—Instituto Brasileiro do Meio Ambiente e dos Recursos Renováveis). The three specimens, preserved as skin and skeleton, and their respective tissue samples are deposited in the Museu de Ciências Naturais da Universidade Luterana do Brasil (ULBRA), *Campus* Canoas (MCNU) in Porto Alegre, Rio Grande do Sul, Brazil by the numbers MCNU3630, MCNU3629, and MCNU3628. The external and craniodental measurements are presented in Table 1.

The identification at genus level was accomplished based on external morphological characters (Bonvicino et al. 2008) easily recognizable (average head and body size, dorsal and lateral fur composed of hardened and awn-shaped guard-hairs, and in general, with gray base and black or yellow extremity) (Figure 2). The identification at specific level considered some diagnostic external and craniodental characters cited by Pardiñas et al. (2009) on the description of *A. chebezi*, and recognizable through specimen comparisons with the original description (Pardiñas et al. 2009) and with other specimens from the two species analyzed. Specimens examined in this study were: MCNU3630, MCNU3629, and MCNU3628, two specimens of *A. ruschii* deposited in Museu Nacional, Rio de Janeiro (MN), MN23075 from Reserva Biológica de Forno Grande, Espírito Santo (locality 1, Figure 1) and MN73415 from São Sebastião das Águas Claras, Minas Gerais (locality 5, Figure 1), besides the photographs of *A. chebezi* (locality 10, Figure 1) in Pardiñas *et al*. (2009). The dorsal and ventral fur color of the individuals collected in this study is composed by a yellow-gray tonality, resembling individuals of *A. ruschii*, while the individuals of *A. chebezi* have a brown tonality. Furthermore, our samples and specimens of *A. ruschii* share a tuft of hairs on the tip of the tail (Figure 3) which is long, hairy, and whitish compared to the shorter and more brownish hairs in *A. chebezi*. Also, the orientation of the upper incisor (defined by the position of the cutting edge of the incisor relative to the vertical plane of the incisors) is slightly opisthodont (88°) in both new specimens and *A. ruschii* analyzed, and is proodont (95°) in *A. chebezi* (Pardiñas et al. 2009). In the quantitative analysis of the skull, our samples and specimens of *A. ruschii* present a larger incisive foramen width, smaller rostral length, larger zygomatic plate width, larger mandible length, and smaller mandible height, when compared to *A. chebezi* (Table 1). Apparently, there is a considerable amount of phenotypic variation in the genus, and the scarcity of available specimens prevents a full evaluation of the variation at intra and interspecific levels (Pardiñas et al. 2009). Based on the current knowledge, the analyzed morphological characteristics seem to us as reliable diagnostic characters to identify the captured individuals as *A. ruschii*.

Table 1. External and craniodental measurements (in mm) of the three adult specimens of *Abrawayaomys ruschii* collected in Chapecó, Santa Catarina state, Brazil. Cranial measurements were taken using digital photography. Also are presented the measures of the two holotypes: *A. ruschii* (MN23075) and *A. chebezi* (MACN20253), the latter measurements taken from Pardiñas et al. (2009). Age class following toothwear classes proposed by Patterson (1992).

	MCNU 3628	MCNU 3629	MCNU 3630	MN23075 Holotype	MACN20253 Holotype
Age class	3	3	4	3	4
Sex	M	F	F	F	M
Head and Body Length	89	104	120	116	120
Tail Length	109	142	139	85	133
Hind Foot length (without claw)	27	29	30	-	27.5
Hind Foot length (with claw)	28	31	32	29	29
Ear length	16	18	17	20	17
Weight (in grams)	25	51	46	46	-
Rostral Width	5.8	6.3	6.4	5.04	5.62
Least Interorbital Breadth	6.9	7.1	7.0	6.29	6.02
Zygomatic Breadth	15.9	17.8	18.3	17.20	16.99
Braincase Width	12.1	13.7	13.9	13.67	13.18
Condylobasal	28.69	30.1	33.8	27.46	27.67
Diastema	7.1	7.1	8.5	7.57	7.68
Palatal Bridge	5.5	6.8	7.2	5.46	5.25
Palatal Length	12.7	13.8	15.2	-	-
Incisive Foramina Length	4.9	4.4	5.8	5.33	4.65
Upper Molar Row Length	4.7	4.5	5.3	4.51	3.96
M1 Breadth	1.5	1.6	1.8	1.32	1.16
Bullar Length Less Tube	5.1	4.9	5.7	5.48	4.84
Mandible Length	16	18.5	19.4	17.30	16.56
Mandible Height	9.5	11	10.6	9.18	9.03
Occipital Condyle Width	8.1	8.3	8.6	8.01	6.53
Incisive Foramina Width	1.6	1.5	1.7	1.72	1.44
Breadth between M1	5.4	5.8	5.7	5.67	5.32
Cranial Height	9.7	9.8	10.3	9.94	9.68
Rostral Length	8.1	9.2	9.0	8.26	10.94
Internal Orbital Length	9.0	9.9	10.1	10.1	9.81
Zygomatic Plate Width	3.3	4.0	3.7	4.34	3.56

Otherwise, there are some apparently morphological idiosyncrasies in the new collected specimens, which differ from both *A. ruschii* and *A. chebezi*. For instance, the condylobasal length is greater in the new specimens than in the others, even considering the smallest individual captured by us (MCNU 3628), as also is the least interorbital breadth. Such features could be related to the geographic distance from these specimens to the others examined. However, other characteristics showed appreciable variation following size of individuals, as the zygomatic breadth, the incisive foramina length, and the bullar length less tube. In these high variable features, the new specimens could be closer related to *A. ruschii* or *A. chebezi* depending on the size of the individuals analyzed. These features show how variable morphological characters can be inside a single population, and this variation can potentially be the same in other regions if we were able to explore more than one or two individuals from a single location. In this way, we advocate that the quantitative differences are highly variable between specimens of *A. ruschii*, and for now we could not detect if there is a geographical pattern explaining this variation.

The species *A. ruschii* appears to be a naturally rare species, because at the nine localities where it was sampled, including this study, it has always been found at low abundance. A great capture effort may be required to increase the probability of surveying individuals from this species. As an example, in our study, we collected just three individuals with an effort of 6,500 trap-nights, resulting in a capture success of 0.046%. In addition, little is known about the ecology of *A. ruschii*, and this new record represents not only an increase in geographical distribution, but it is also the second record inside the interior Atlantic Forest (see Cerboncini et al. 2014), where forest phytophysiognomy is different from Atlantic Forest *stricto sensu*, increasing the habitat range occupied by this species.

It is remarkable that the new record of *A. ruschii* is geographically closer to records from *A. chebezi* (ca. 200 km from the region of Misiones, Argentina), than from records of *A. ruschii* (ca. 370 km) (Figure 1). This may suggest that there is a continuum in the geographic distribution of both species, and perhaps even sympatric areas among them may occur. Inventories on the intermediate region between the new record and that of *A. chebezi* (east of Misiones and extreme western of Santa Catarina state) would help to reveal the distribution limits of each species. No geographic barrier is evident among these localities. Also, considering the great morphological variation within *A. ruschii* specimens (as evidenced in the three specimens here examined), it is necessary that a molecular analysis is done taking into account all specimens available to date, in order to better understand this variation and to help delimit the species in the genus. Future studies

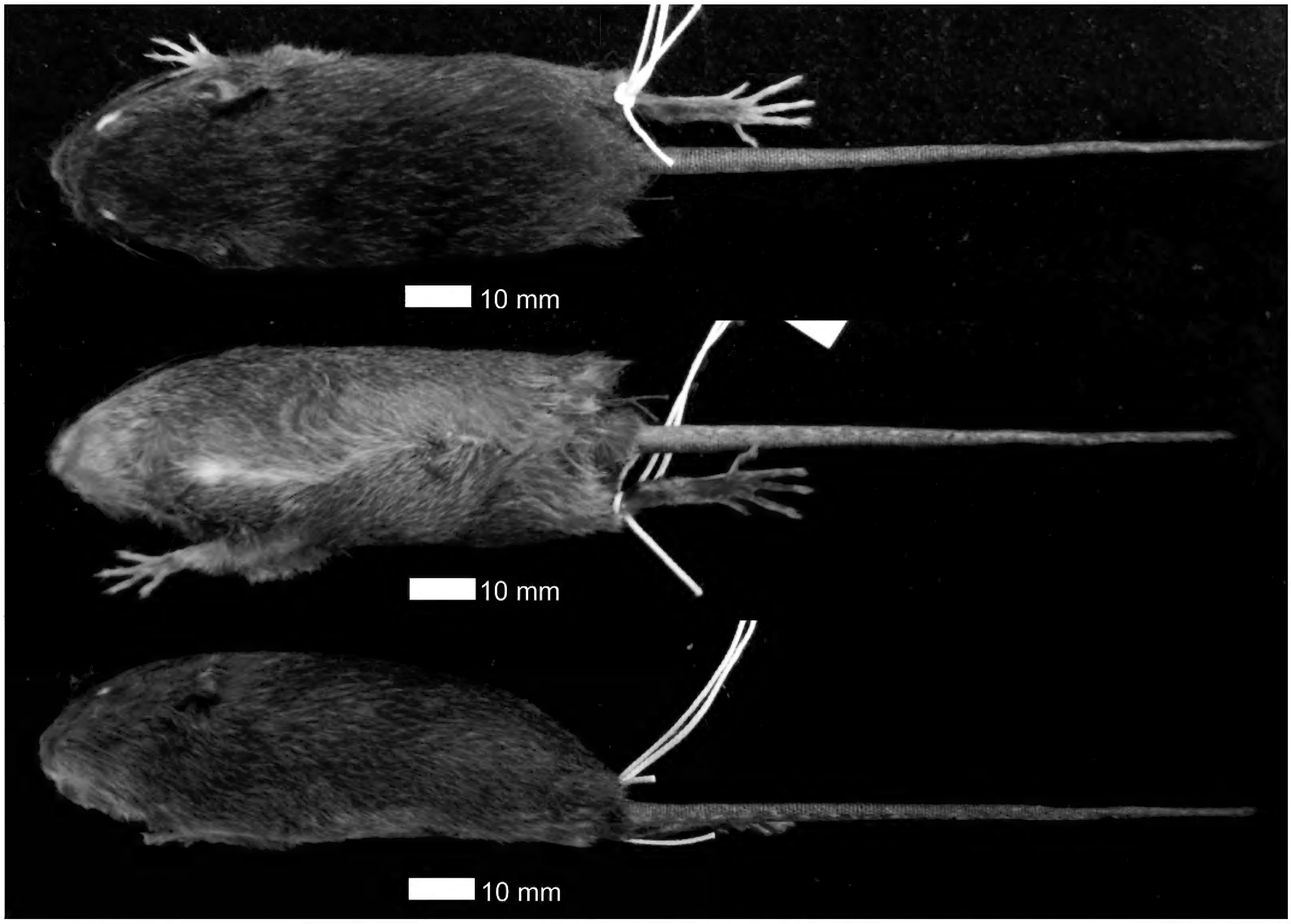

Figure 2. *Abrawayaomys ruschii* adult female MCNU3629 collected in Chapecó, Santa Catarina state, southern Brazil. Dorsal, ventral, and lateral views of the skin. The scale bar (white) in each photo represents 10 mm.

along the Atlantic Forest biome including intermediate areas of occurrence between both species of *Abrawayaomys* may help to elucidate biogeographic questions in this genus.

Finally, an addendum on the method, considering the known difficulties on the capture of this species: possibly, the great sampling effort employed on this area, in addition to the methodology of pitfall traps (6,500 pitfall-nights), contributed to the capture of *A. ruschii*. The use of interception and fall traps allows a broader sampling of the community (captures more than one individual per night), is less selective (does not have bait), and often capture a greater species richness (Umetsu et al. 2006; Cáceres et al. 2011). So our results are in accordance with previous studies (Passamani et al. 2011), and the use of this capture method combined with long-term surveys should be encouraged in small mammal studies.

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LITERATURE CITED

Bonvicino, C.R., J.A.Oliveira and P.S. D'Andrea. 2008. Guia dos roedores do Brasil, com chaves para gêneros baseadas em caracteres externos. – Rio de Janeiro, Centro Pan-Americano de Febre Aftosa, OPAS-OMS. http://www.fiocruz.br/ioc/media/livro%20roedores.pdf

Cáceres, N.C., R.P. Nápoli, and W.Hannibal. 2011. Differential trapping success for small mammals using pitfall and standard cage traps in a woodland savannah region of southwestern Brazil. Mammalia 75: 45–52. http://www.degruyter.com/view/j/mamm.2011.75.issue-1/mamm.2010.069/mamm.2010.069.xml

Cerboncini, R.A.S., T.B. Zanata, W.L. Cunha, A.M. Rorato, A.S. Calefi, M.R. Sbeghen, R. Macagnan, K.C. Abreu, M.A. Ono, F.C. Passos. 2014. Distribution extension of *Abrawayaomys ruschii* Cunha and Cruz, 1979 (Rodentia: Cricetidae) with the first records in the state of Paraná, southern Brazil. Check List 10(3): 660–662. doi: 10.15560/10.3.660

Cherem, J.J., M.E. Graipel, M. Tortato, S. Althoff, F. Brüggemann,

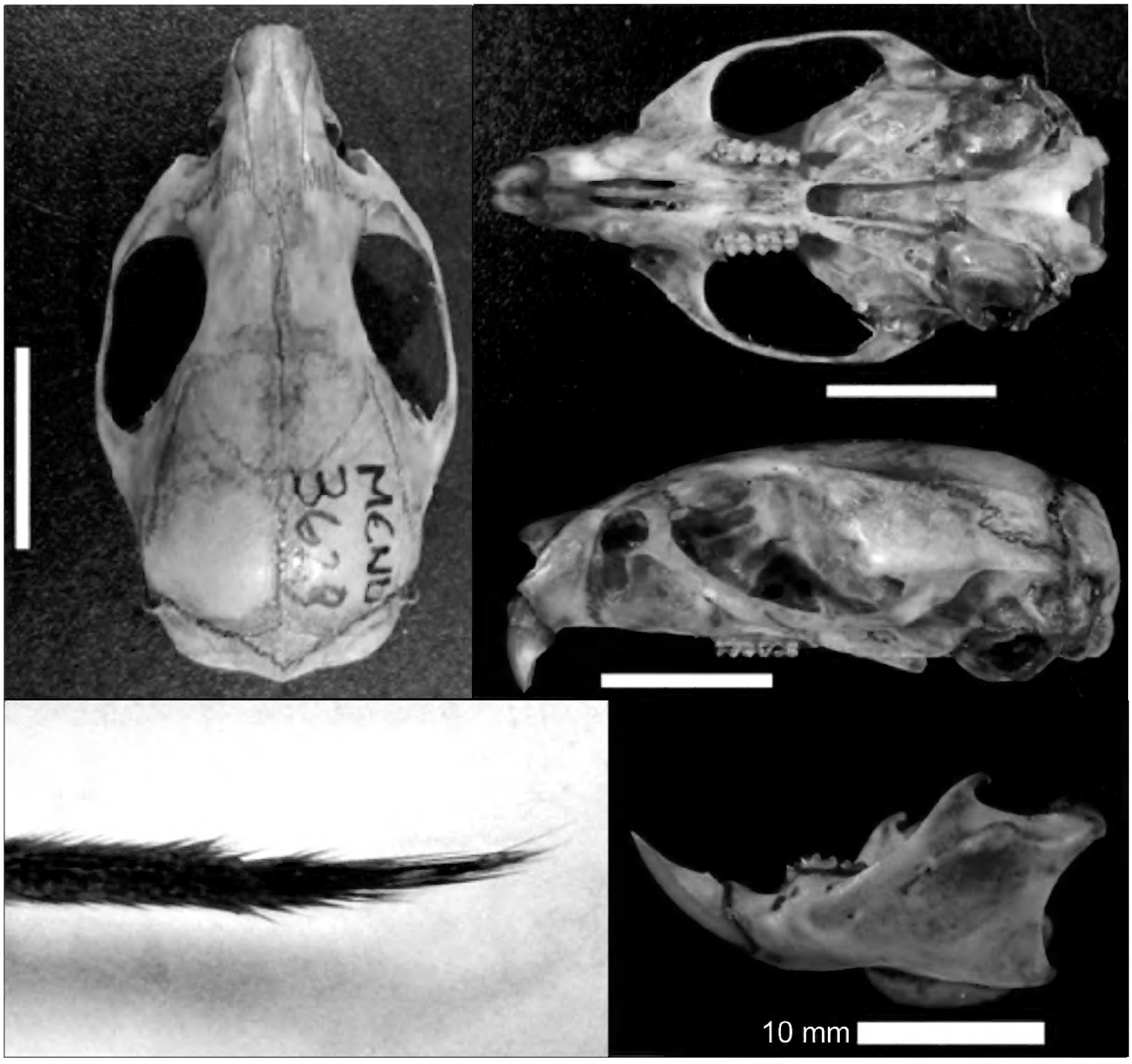

Figure 3. *Abrawayaomys ruschii* adult female MCNU3629 collected in Chapecó, Santa Catarina state, southern Brazil. Dorsal, ventral, and lateral views of the skull. On the bottom, left photo, the brush of hairs of the tail tip. On the bottom right, lateral view of the mandible. The scale bar (in white) in each photo represents 10 mm.

J. Matos, J.C. Voltolini, R. Freitas, R. Illenser, F. Hoffmann, I.R. Ghizoni-Jr., A. Bevilacqua, R. Reinicke, C.H. Salvador, A. Filippini, N. Furnari, K. Abati, M. Moraes, T. Moreira, L.G.R. Oliveira-Santos, V. Kuhnen, T. Maccarini, F. Goulart, H. Mozerle, F. Fantacini, D. Dias, R. Penedo-Ferreira, B.P. Vieira, P.C. Simões-Lopes. 2011. Mastofauna terrestre do Parque Estadual da Serra do Tabuleiro, estado de Santa Catarina, sul do Brasil. Biotemas 24(3): 73–84. doi: 10.5007/2175-7925.2011

D'Elía, G., U.F.J. Pardiñas, P. Teta, J.L. Patton. 2007. Definition and diagnosis of a new tribe of sigmodontinae rodents (Cricetidae: Sigmodontinae), and a revised classification of the subfamily. Gayana 71(2): 187–194. http://www.scielo.cl/pdf/gayana/v71n2/art%2007.pdf

IBGE. 2011. Instituto Brasileiro de Geografia e Estatística. Mapa de biomas do Brasil. Accessed at ftp://ftp.ige.gov.br/Cartas_e_Mapas/Mapas_Murais, 18 February 2014.

Pardinas, U., P. Teta and A. Percequillo. 2008. *Abrawayaomys ruschii*. The IUCN Red List of Threatened Species. Version 2014.3. Accessed at http://www.iucnredlist.org/details/16/0, 24 February 2014.

Maestri, R., D. Galiano, B.B. Kubiak, J.R. Marinho. 2014. Diversity of small land mammals in a subtropical Atlantic forest in the western region of the state of Santa Catarina, southern Brazil. Biota Neotropica 14(4): 1–7. doi: 10.1590/1676-06032014012914

Pardiñas, U.F.J., P. Teta and G. D'Elía. 2009. Taxonomy and distribution of *Abrawayaomys* (Rodentia: Cricetidae), an Atlantic Forest endemic with the description of a new species. Zootaxa 2128: 39–60. http://www.mapress.com/zootaxa/2009/f/z02128p060f.pdf

Passamani, M., R.A.S. Cerboncini and J.E. Oliveira. 2011. Distribution extension of *Phaenomys ferrugineus* (Thomas, 1894), and new data on *Abrawayaomys ruschii* Cunha and Cruz, 1979 and *Rhagomys rufescens* (Thomas, 1886), three rare species of rodents (Rodentia: Cricetidae) in Minas Gerais, Brazil. Check List 7(6): 827–831. http://www.checklist.org.br/getpdf?NGD095-11

Patterson, B.D. 1992. A new genus and species of long-clawed mouse

(Rodentia: Muridae) from temperate rainforests of Chile. Zoological Journal of the Linnean Society 106: 127–145. doi: 10.1111/j.1096-3642.1992.tb01243.x

Peel, M.C., B.L. Finlayson and T.A. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences 11: 1633–1644. http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007.html

Pereira, L.G., G. Lena, A.A. Cunha and R. Cerqueira. 2008. *Abrawayaomys ruschii* Cunha & Cruz, 1979 (Rodentia, Cricetidae) no Estado do Rio de Janeiro, Brasil. *Papéis Avulsos de Zoologia (São Paulo)* 48(5): 33–40. doi: 10.1590/S0031-10492008000500001

Umetsu, F., L. Naxara and R. Pardini. 2006. Evaluating the efficiency of pitfall traps for sampling small mammals in the neotropics. Journal of Mammalogy 87(4): 757–765. doi: 10.1644/05-MAMM-A-285R2.1

Ventura, K., M.J.J., Silva, L. Geise, Y.L.R. Leite, U.F.J. Pardinãs, Y. Yonenaga-Yassuda and G. D'Elia. 2013. The phylogenetic position of the enigmatic Atlantic Forest-endemic spiny mouse *Abrawayaomys* (Rodentia: Sigmodontinae). Zoological Studies 52(55): 1–10. doi: 10.1186/1810-522X-52-55

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